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1978–79 SURVEY OF PHYSICS AND ASTRONOMY BACHELOR'S DEGREE RECIPIENTS

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The major objective of this survey of bachelor's degree recipients in physics and astronomy is to determine the graduates' postbaccalaureate plans. A different AIP survey determined the total number of bachelor's degrees granted during the 1978-79 academic year: 4416 physics degrees and 165 astronomy degrees. Highlights of this report are:

- a 4% shift in postbaccalaureate plans away from graduate study and into employment for physics bachelors
- a sharp increase in astronomy bachelors interested in immediate employment
- a 15% increase in starting salaries for 1979 physics bachelors over the 1978 graduating class.

Figure 1 shows the changes in the four postbaccalaureate plans since 1970 when the graduating class was 30% larger than it was in 1979. Civilian employment fluctuated considerably during the decade of the 1970's as the job market improved gradually. Those bachelors who reported "other graduate study" usually choose a discipline that is closely related to physics.

Table I presents the numerical data on which **Figure 1** is based and also includes a small group of graduates who are undecided about their postbaccalaureate plans. The last row of **Table I** gives the total number of physics bachelor's degrees granted in the United States.

Fig. 1. Trend in postbaccalaureate plans of physics bachelors, 1969-79

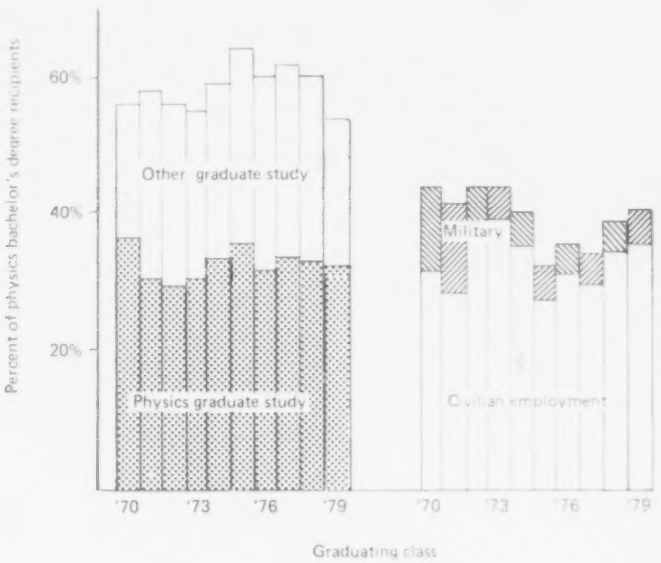


Table I. Postbaccalaureate plans of successive graduating classes of physics bachelors, 1969-1979.

	Graduating Class									
Postbaccalaureate plans	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79
Physics graduate study	37%	31%	30%	31%	34%	36%	32%	34%	33%	31%
Other graduate study	19	26	26	24	25	27	28	28	26	24
Civilian employment	32	29	37	39	36	28	31	30	34	38
Military service	12	12	7	5	4	4	4	4	5	5
Undecided	-	2	-	1	1	5	5	4	2	2
Total number of physics bachelor's degrees	5782	5755	5282	4923	4652	4571	4487	4517	4457	4416

Table II. Characteristics of physics bachelor's degree recipients, 1978–79.

Characteristics	Postbaccalaureate plans: Graduate study physics	Graduate study other	Employment	Undecided	Total
Sex					
Female	11%	15%	13%	28%	12.8%
Male	89	85	87	72	87.2
Citizenship					
U.S.	92%	95%	98%	98%	95.6%
Foreign	8	5	2	2	4.4
Age					
20 or younger	2%	1%	1%	2%	1.0%
21	9	9	4	–	6.7
22	51	52	45	35	48.2
23	21	22	23	35	22.4
24–29	15	14	22	21	17.7
30 and older	2	2	5	7	4.0
Minority group					
Black	1.2%	2.3%	0.8%	–	1.3%
Mexican American	0.5	0.5	0.4	2%	0.6
Other Spanish	1.5	1.1	0.4	–	0.9
American Indian	0.3	0.2	0.3	2	0.3
Asian Indian	0.4	0.5	0.4	–	0.4
Oriental	4.1	2.3	1.6	6	2.6
Arab	0.9	0.9	0.5	–	0.7
Type of high school physics					
PSSC	29%	29%	29%	36%	29.2%
Project physics	15	17	16	13	15.7
Other	43	39	41	33	41.2
None	13	15	14	18	13.9
Type of undergraduate institution					
PhD-granting	62%	48%	46%	49%	51.5%
MS-granting	13	10	13	7	12.2
BS/BA-granting	25	42	41	44	36.3
Type of degree:					
Science	74%	60%	69%	59%	68.2%
Arts	26	40	31	41	31.8
Total number of bachelors	1372	1083	1875	86	4416
% distribution	31%	24%	43%	2%	100%
Number of respondents	760	600	1039	48	2447

Table III. Postbaccalaureate plans of the members of minority groups among the physics bachelors of the class of 1979.

Minority group:		Black	Mex. Am.	Am. Ind.	Other Latin	Asian Indian	Oriental U.S.	Oriental Foreign	Arab
Graduate study in physics		9	4	2	11	3	10	24	7
Other graduate study		13	3	1	6	3	9	4	5
Engineering		8	–	–	–	–	4	2	3
Medicine or biophysics		2	–	1	1	–	–	–	–
Computer sciences		2	–	–	1	–	1	–	–
Other		1	3	–	4	3	4	2	2
Employment		8	5	4	5	4	12	4	6
Number of job offers	0	1	–	–	–	–	–	1	2
	1	3	2	1	3	3	4	3	3
	2	1	1	2	–	–	3	–	–
	≥3	3	2	1	2	1	5	–	1
Total in survey:		30	12	7	22	10	31	32	18

Table IV. Sources of anticipated support for first-year graduate study*, 1974 and 1979.

Sources of support		Students planning: physics graduate study		Students planning: other graduate study	
		1974	1979	1974	1979
Teaching assistantship		63%	66%	19%	24%
Research assistantship		12	15	20	24
Fellowship		13	12	13	15
Employment		6	2	17	11
Family, savings, loan		5	3	23	20
Other		1	2	8	6
Assured		90%	91%	76%	77%
Intended		10	9	24	23
Graduate study status	full-time	98%	98%	96%	96%
	part-time	2	2	4	4
Total	%	100%	100%	100%	100%
	N	1600	1372	1220	1083

**The information was reported as of September of each academic year.*

Table II presents seven characteristics of the physics graduating class of 1979. While most of the characteristics do not change significantly from year to year, sex and citizenship are the exceptions. There has been a steady increase in the proportion of women among physics students since the early 1970's when 7% of a graduating class were women; between 1978 and 1979 the percentage increased from 11.6 to 12.8. Foreign students among the undergraduates have always been few; however, **Table II** shows that they comprise 8% of the bachelors whose plan is graduate study in physics—an increase from 5% in the previous year. For a number of years the median age rose at which graduates completed their bachelor's degrees; the Class of 1979 is the first to reverse that trend. Back in 1972, 64% of the bachelors were 22 years or younger, for the Class of 1979 this percentage dropped to 56%.

The first part of the questionnaire sent to each degree recipient deals with background characteristics, one of which is a listing of six distinct minority groups. In the 1979 survey almost 7% of the 2447 respondents identified themselves as members of a minority group, including 18 Arabs who specified their group under "other".

A significant difference exists between the postbaccalaureate plans of minorities and those of all physics bachelors; 70% of the former group compared with 56% of the latter plan to enter graduate school upon receiving the bachelor's degree. One reason for the large proportion of minorities interested in graduate study is that approximately half of them are foreign citizens and presumably on student visas in the U.S. Details of the plans of each group are shown in **Table III**.

Where sources of support for first-year graduate students are concerned, differences are primarily related to subject of graduate study rather than time. An examination of the data in **Table IV** shows how few changes occurred in a five-year period; on the other hand the large percentage of first-year physics students who are assured of assistantships can be contrasted with the situation of those students interested in "other graduate study".

Also conspicuous among the sources of support is the one described as family funds, savings or loans; only 3% of the graduate students avail themselves of such a source, while 20% of students interested in "other graduate study" support themselves through those means. Very few in either group of graduate students plan to study on a part-time basis and a high proportion of each group is assured of the reported sources of support.

The steady improvement in employment opportunities for successive graduating classes since 1972 is shown by **Table V**, both in terms of a declining percentage of graduates with zero job offers and an increasing percentage with multiple offers.

Table V. Changes in employment outlook for the new physics bachelor's degree recipients, 1972-79.

Number of job offers at graduation	Summer 1972	Summer 1973	Summer 1974	Summer 1975*	Summer 1976*	Summer 1977	Summer 1978	Summer 1979
0	41%	26%	18%	17%	17%	11%	10%	9%
1**	42	50	50	56	53	52	45	46
2 or more	17	24	32	27	30	37	45	45

**These figures have been revised from those presented in earlier reports to include military commitments.*
***Bachelors who enter the military service are included here.*

Fig. II. Postbaccalaureate plans of the class of 1979

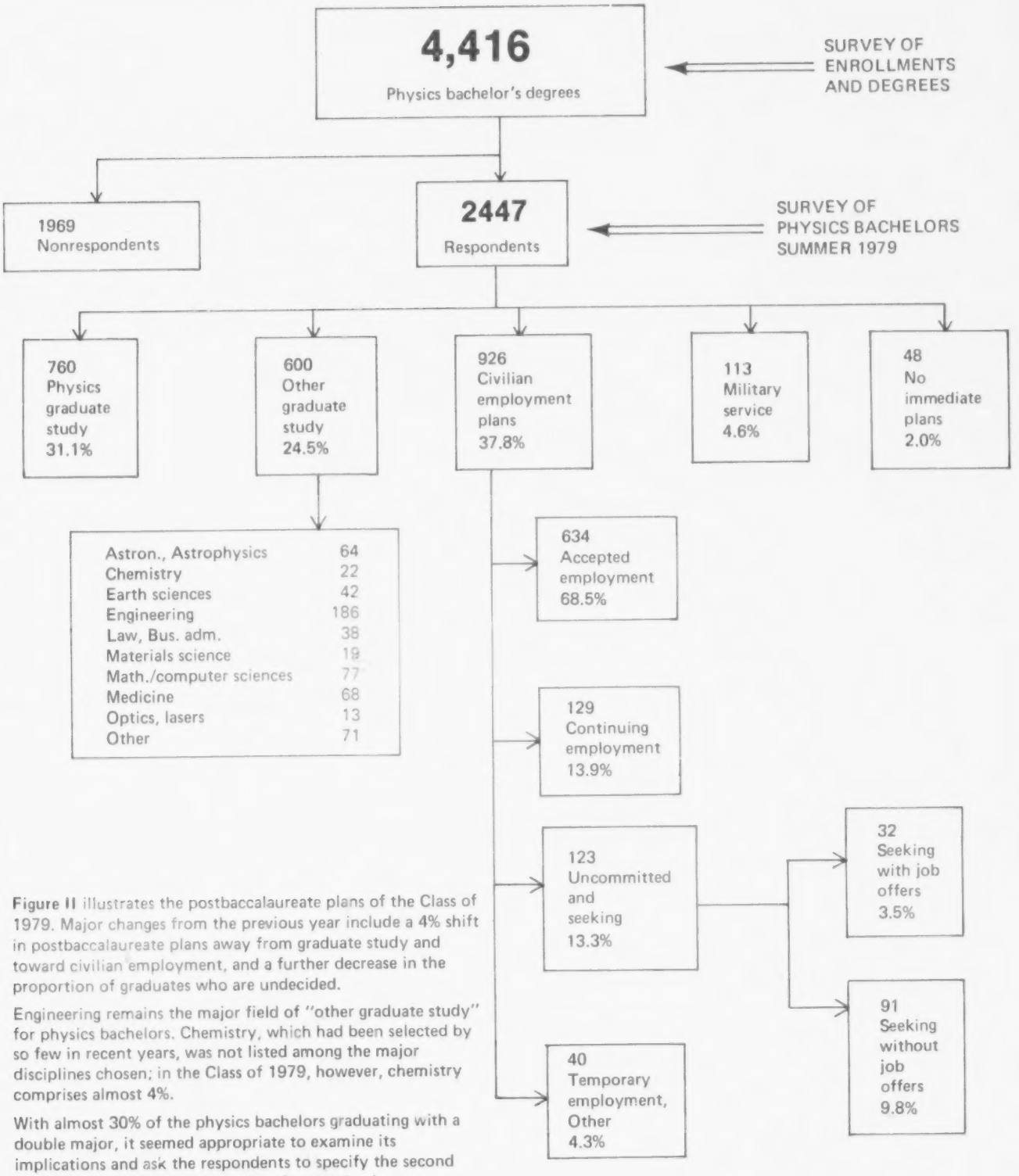
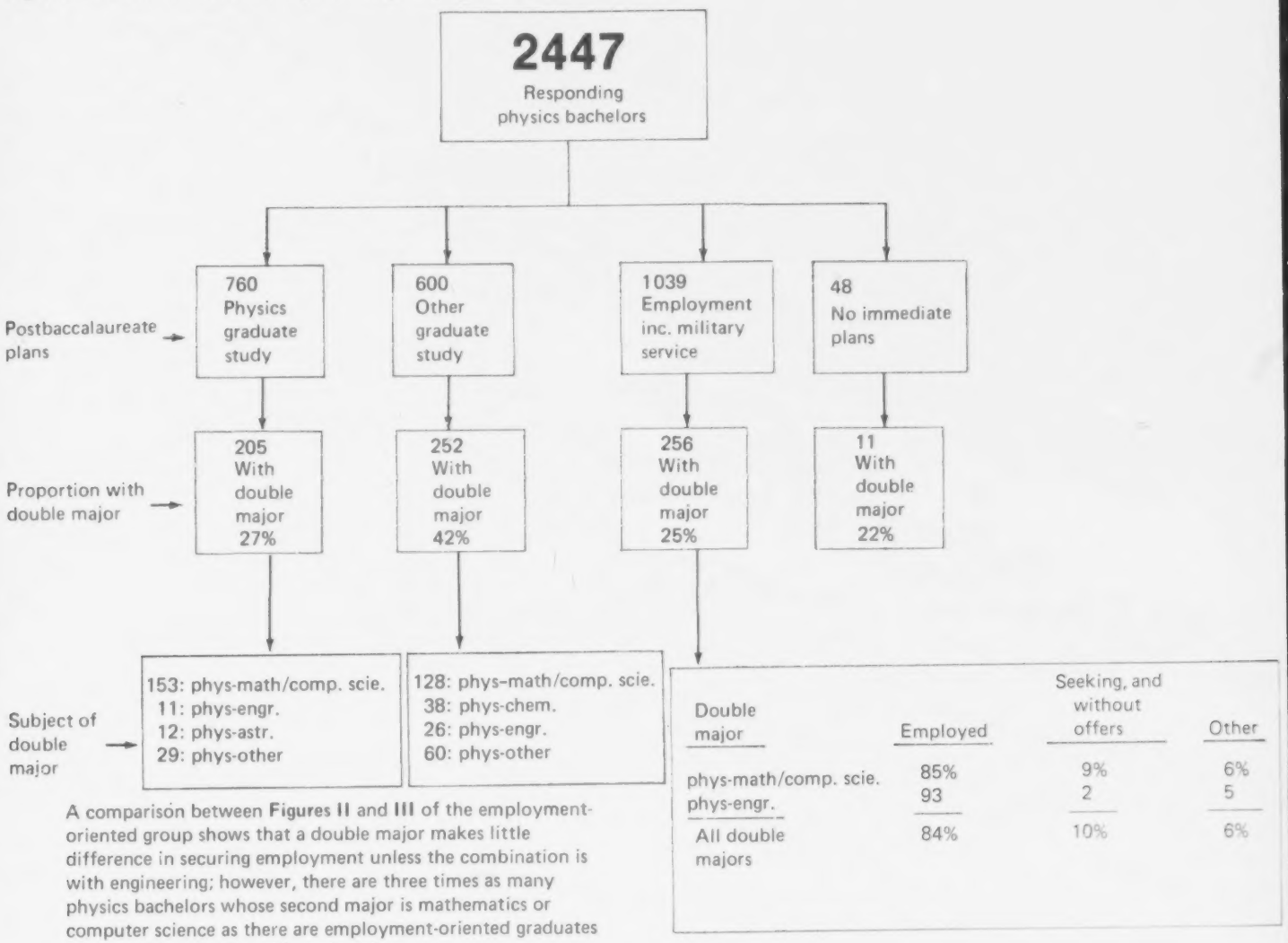


Figure II illustrates the postbaccalaureate plans of the Class of 1979. Major changes from the previous year include a 4% shift in postbaccalaureate plans away from graduate study and toward civilian employment, and a further decrease in the proportion of graduates who are undecided.

Engineering remains the major field of "other graduate study" for physics bachelors. Chemistry, which had been selected by so few in recent years, was not listed among the major disciplines chosen; in the Class of 1979, however, chemistry comprises almost 4%.

With almost 30% of the physics bachelors graduating with a double major, it seemed appropriate to examine its implications and ask the respondents to specify the second major. **Figure III** presents the most frequently chosen combinations and relates them to the postbaccalaureate plans. As expected, the group interested in nonphysics graduate study has the highest proportion of graduates with double majors and many of them chose that second major as their field of graduate study.

Fig. III. Graduates with double majors among the physics bachelors.



Double major	Employed	Seeking, and without offers	Other
phys-math/comp. scie.	85%	9%	6%
phys-engr.	93	2	5
All double majors	84%	10%	6%

A comparison between **Figures II** and **III** of the employment-oriented group shows that a double major makes little difference in securing employment unless the combination is with engineering; however, there are three times as many physics bachelors whose second major is mathematics or computer science as there are employment-oriented graduates who combine physics with engineering.

Industry continues to be the largest employer of physics bachelors as one can observe in **Table VI**. There are two categories of industrial positions for bachelors: one is designated "manufacture" and the other "service". In this manner one can distinguish between positions that utilize more heavily the graduates' physics training, and those that require primarily a college degree or the ability to deal with numbers; banks and insurance companies are examples of "service industries" included in **Table VI**. A three percentage point shift from service to manufacture occurred between 1978 and 1979.

Table VI. Initial employment of physics graduates with bachelor's degrees, 1973–79

Type of employer	Percentage of employed bachelors					
	1973–74	1974–5	1975–76	1976–77	1977–78	1978–79
Industry manufacture	32%	25%	30%	32%	37%	40%
Industry service	22	25	19	16	21	18
High school	10	11	11	8	7	6
College or univ.	4	5	4	5	3	4
Government civilian employ.	10	9	10	7	7	7
Government career military	10	16	13	12	14	15
Res. institutes	5	4	3	7	7	6
Other	7	5	10	13	4	4
Total	100%	100%	100%	100%	100%	100%

Table VII. Use of physics training by type of employment, physics bachelors, 1979.

Newly accepted positions with selected types of employers	Use of physics training			Number reporting
	Extensive	Little	None	
Secondary schools	50%	44%	6%	34
Industry-manufacture	55	41	4	282
Industry-service	40	45	15	124
Govt., Peace Corps	35	57	8	51
Research institutes	61	33	6	49
Continuing employment with selected types of employers				
Industry	26%	56%	18%	80
All employers (newly accepted positions)	49%	44%	7%	586
Selected work activities in newly accepted positions				
Science teaching	56%	39%	5%	41
Research & development	73	25	2	173
Engineering	51	47	2	210
Computer programming	16	67	17	61
Skilled work	30	52	18	29
Nonphysics professional	1	68	31	20

A measure of the quality of the job market is the extent to which a graduate's initial employment utilizes his or her physics training. **Table VII** addresses itself to that topic and shows that half of the new graduates at the bachelor's level feel that they are making extensive use of their education. In a comparison with the previous year, initial industrial employment offers more physics related positions, and the number of graduates who identified their work activity as research and development increased from 135 to 173.

With the amount of attention focused on inflation lately salary information is in great demand. **Table VIII** lists the median monthly salaries offered by five types of employers to men and women. For all employers combined the median salary increased 15% over the previous year. A slightly higher proportion of women than men accepted high school teaching positions for which the salaries increased 27% in one year. More than ten years ago we started to publish separate salaries for men and women graduates with physics bachelor's degrees; 1979 is the second successive year in which women report a higher median salary than men. Were one to exclude the military, male graduates would show higher salaries for civilian employers.

The comparable median starting salary for chemistry graduates is $1 180.00 and therefore almost 12% lower than that paid to physics graduates employed full-time.

Table VIII. Starting salaries of new physics bachelors, 1979.

	Men (612 reported salaries)		Women (86 reported salaries)		Total (698 reported salaries)	
Type of employer	Distr. by employer	Median monthly salary	Distr. by employer	Median monthly salary	Distr. by employer	Median monthly salary
Industry-manufacture	40%	$1515	44%	$1515	40%	$1515
Industry-service	18	1420	19	1375	18	1410
High school	5	860	8	950	6	865
College or university	4	1030	5	*	4	1025
Government (civilian)	7	1155	6	1150	7	1155
Government (military)	17	1015	6	990	15	1015
Research institute	6	1350	8	1100	6	1335
Other	3	1200	4	*	4	1150
Total	100%	$1330	100%	$1343	100%	$1333

**Insufficient data*

Table IX. Full-time employment* of new physics bachelor's degree recipients, 1979.

Work activity		Type of employer: Industry manufacture	Industry service	High school	Government civilian employment	Government military service	Research institute	Other	Total N	Total %
Teaching		–	–	41	1	–	1	5	48	6
Research & development		110	27	–	16	13	31	19	216	28
Engineering		148	43	–	18	28	8	7	252	33
Computer programming		30	32	1	6	1	5	6	81	11
Nonphysics professional		9	11	–	2	24	–	4	50	6
Skilled		6	10	–	7	6	2	8	39	5
Other		9	19	1	7	41	2	9	88	11
Total	N	312	142	43	57	113	49	58	774	
	%	40%	18%	6%	7%	15%	6%	8%		100%

**The employment of these 774 graduates includes both newly accepted positions as well as those in which graduates are continuing.*

The bachelors presented in **Table IX** who reported both employer and work activity, include graduates who chose to continue the employment they acquired before completing their bachelor's degrees; for that reason the totals for research and development, engineering, etc. are larger in **Table IX** than in **Table VII**. Changes in the distribution of work activities from the previous year are minor. Teaching decreased by 3% and research and development increased by 5%.

ASTRONOMY

Table X. Postbaccalaureate plans of successive graduating classes of astronomy bachelors, 1974-1979.

Postbaccalaureate plans	1974-75	1975-76	1976-77	1977-78	1978-79
Astronomy graduate study	42%	46%	28%	33%	28%
Other graduate study	29	29	27	22	19
Employment	23	20	33	40	51
Undecided	6	5	12	5	2
Total number of astronomy bachelors	163	172	184	177	165

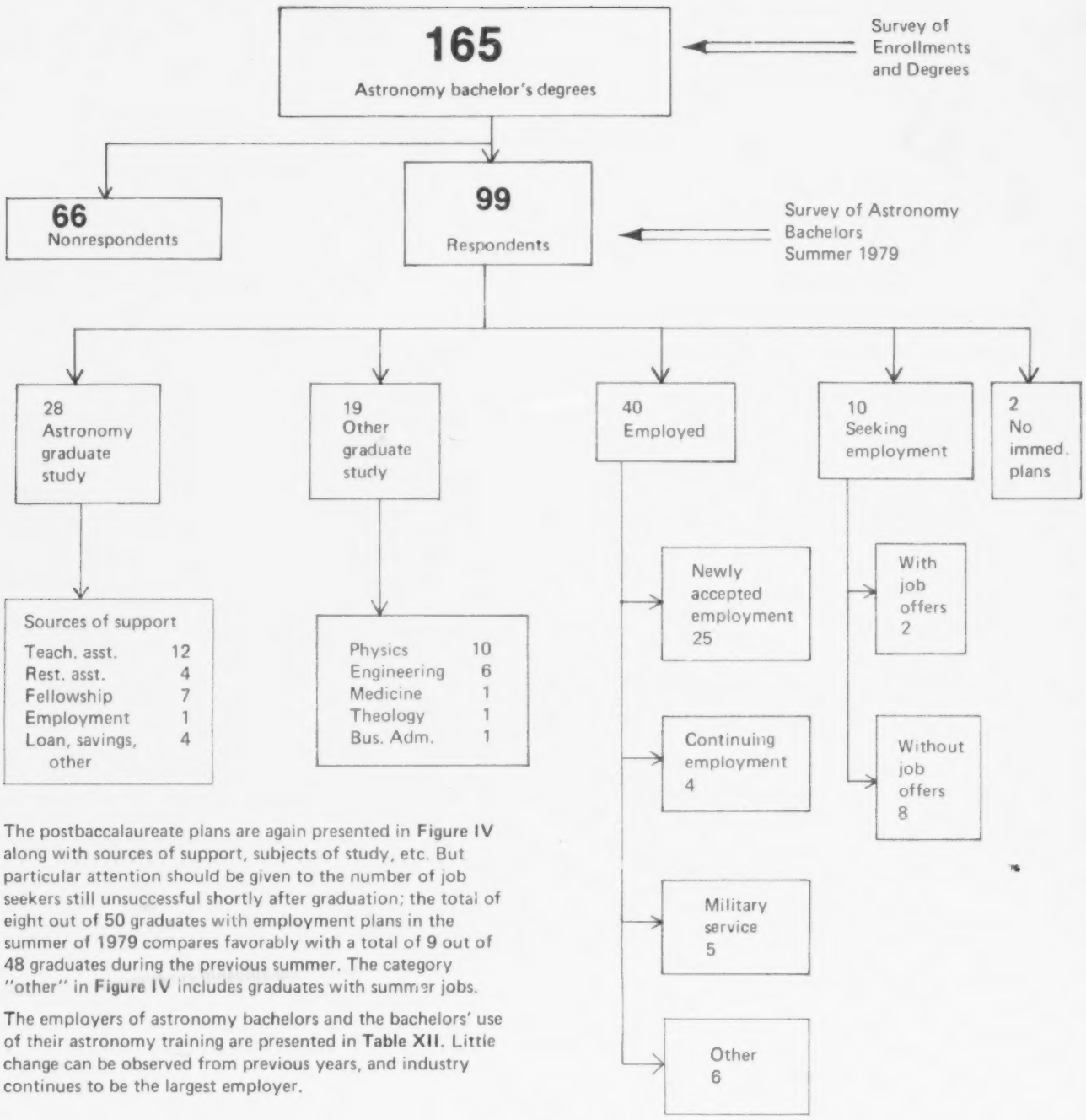
Since its beginning five years ago the survey of astronomy bachelors had approximately one hundred respondents each year; hence greater percentage fluctuations can be expected from year to year among astronomy graduates than among the 4500 physics graduates. **Table X** depicts a sharp increase in astronomy bachelors with immediate employment plans since the mid 1970's. "Other graduate study" for astronomy bachelors primarily refers to physics, whereas only one in ten physics bachelors who report "other graduate study", choose astronomy. The flow diagram on page 8 offers details on what those other subjects of graduate study are.

The characteristics of astronomy bachelors, recorded in **Table XI**, are also listed by postbaccalaureate plan of the astronomy graduate. Comparisons with previous years point to several continuing trends: proportionately more women among astronomy bachelors than among physics bachelors, a very small number of foreign students, and very few minority graduates.

Table XI. Characteristics of astronomy bachelors, 1979.

Characteristics		Postbaccalaureate plans: Astronomy graduate study	Other graduate study	Employment	Total
Sex	Female	6	4	10	20
	Male	22	15	42	79
Citizenship	U.S.	28	19	51	98
	Foreign	–	–	1	1
Race	Black	–	–	1	1
	Oriental	–	–	1	1
	Latin Am.	1	–	–	1
Age	21 yrs.	4	1	2	7
	22	16	9	24	49
	23	5	8	16	29
	24 or older	3	1	10	14
Type of bachelor's institution	PhD-granting	26	16	43	85
	Master's-granting	2	1	5	8
	Bachelor's-granting	–	2	4	6
Type of degree	Science	19	7	42	68
	Arts	9	12	10	31
Total number of astronomy bachelors		28	19	52	99

Fig. IV. Postbaccalaureate plans of the class of 1979.



The postbaccalaureate plans are again presented in **Figure IV** along with sources of support, subjects of study, etc. But particular attention should be given to the number of job seekers still unsuccessful shortly after graduation; the total of eight out of 50 graduates with employment plans in the summer of 1979 compares favorably with a total of 9 out of 48 graduates during the previous summer. The category "other" in **Figure IV** includes graduates with summer jobs.

The employers of astronomy bachelors and the bachelors' use of their astronomy training are presented in **Table XII**. Little change can be observed from previous years, and industry continues to be the largest employer.

Table XII. Employment of astronomy bachelors, 1979.

Type of employer	Use of astronomy training: Extensive	Little	None	Total
High school	2	–	–	2
Coll/university	2	–	1	3
Industry	2	11	7	20
Government: civilian	–	2	2	4
Government: military	–	2	3	5
Research institute	6	–	–	6
Total	12	15	13	40